

## **Remarks**

The various parts of the Office Action (and other matters, if any) are discussed below under appropriate headings.

### ***Response to Amendment***

The withdrawal of the rejection of claims 1-21 based on the Emmerson et al. article is noted with appreciation.

### ***Allowable Subject Matter***

The indicated allowability of claims 6, 7 and 13 is also noted with appreciation. Rewriting of these claims in independent form is being deferred pending reconsideration of the newly stated rejections.

### ***Claim Rejections - 35 U.S.C. § 102 and § 103***

Claims 1-5, 8-12 and 14-21 have been rejected as being anticipated by or unpatentable over US 5066133 ("*Brienza*"), US 6573026 ("*Aitken*") and/or US 6221566 ("*Kohnke*"). The Examiner's remarks in support of the rejections have been carefully considered, but it is respectfully submitted that the applied references neither anticipate nor render obvious the subject matter of the claims, as will become apparent from the following comments.

A method of writing a waveguide channel of increased refractive index into a sample according to claim 1 comprises the provision of a sample having a photosensitive region, and the generation of a light spot with intensity fringes. The spot is then moved through the photosensitive region to create the channel by exposure of the photosensitive region to the light. The presence of the fringes in the spot enables the creation of a regular channel waveguide plus the creation of a grating within the channel, by control of the relative movement of the sample and light spot and the continuity of exposure to the light spot during the movement.

*Brienza* has not been found to describe such a method. *Brienza* describes a method of forming a grating in a pre-existing optical waveguide. See, for example, column 3, lines 51-53. The method described by *Brienza* is only a method of forming a grating, not a method of forming a waveguiding channel as recited in claim 1.

As is typical in known methods for forming gratings via the photosensitive effect, a pattern of light and dark optical intensity fringes is formed by *Brienza*. The fringes correspond to the lines of the desired grating. The pattern is then applied to the pre-existing waveguide to expose alternating parts of the waveguiding channel so as to define the grating lines. In such a method, because the waveguiding channel has already been made by some other method, the width of the intensity fringe pattern is irrelevant, because this parameter is not relevant to the process of writing the grating lines by exposure to the fringes. For this reason, *Brienza* is silent on the subject of the width of the intensity pattern, and in particular does not describe any relationship between the width of the intensity pattern and the width of the waveguiding channel.

According to claim 1, the spot is used to directly create the waveguiding channel, which does not pre-exist in the sample. Therefore, the width of the spot defines the resulting width of the waveguiding channel and, according to claim 1, the spot is generated accordingly so that it has an appropriate width related to the desired width of the channel. *Brienza* does not teach this feature, because the pattern of fringes is not used to create the waveguide, only to create the grating, and it does not matter what width the fringe pattern has.

The method of forming a grating taught by *Brienza* seeks to provide a way of making a grating that is longer than the pattern of intensity fringes. This is done by passing the light used to create the pattern of intensity fringes through a diffractive inscription grating 36 that continuously moves sideways along the length of the pattern. The effect of this is that the fringes in the pattern constantly travel across the area of the pattern with fringes disappearing from the pattern at one end and new fringes arriving at the other end (column 7, lines 51-55). The fringes are not static with respect to the light spot or pattern as a whole. Claim 1 has been amended to highlight this distinction, and support for the amendment can be found, for instance, on page 15, lines 6-28.

The optical fibre onto which the pattern is projected is moved sideways at the same speed as the inscription grating. Although the optical fibre moves relative to the pattern as a whole, the individual fringes, which are moving within the pattern, are stationary relative to the optical fibre. In this way, a long fringe pattern is effectively "rolled" along the fibre length so that only a small part of the pattern is exposed onto the fibre at any time, thereby forming a grating that is longer than the light spot defining the pattern.

In contrast, according to claim 1, the intensity fringes are static within the light spot, so that the relative movement of the sample and the light spot is also relative movement between the sample and the intensity fringes. In this way, the exposure of the photosensitive region to the individual fringes is averaged out or "smeared", giving a uniform exposure so that a waveguiding channel of substantially constant refractive index change can be written. In *Brienza*, the intensity fringes remain fixed relative to the optical fibre. This causes a grating to be formed, but cannot form a waveguiding channel (as set forth in claim 1) because the exposure to the light is in discrete fringes only.

For at least these reasons, *Brienza* does not anticipate nor render obvious the subject matter of claim 1.

Regarding *Aitken*, a method of forming a waveguiding channel of increased refractive index in a sample of material is described. *Aitken*, however, has not been found to use a spot of light having a periodic intensity pattern of high and low intensity fringes, as set forth in claim 1.

In the remarks made in support of the rejection based on *Aitken*, the Examiner was of the view that columns 7-9 of *Aitken* describe a spot with a periodic intensity pattern of high and low intensity fringes. The passage referenced by the Examiner has been carefully reviewed, but such passage as well as the balance of *Aitken* do not appear to support the Examiner's view. As understood, the spot of light used by *Aitken* instead is a regular focused spot, with no interference fringes.

The Examiner may have mistaken the light patterns shown in Figures 6B, 8 and 10A-10D, which do have fringes, for the light spots used by *Aitken* to write waveguides. In actual fact, these fringed patterns are far-field light patterns generated by the output from some sample waveguides after they are written. The apparatus shown in Figure 5 was used to record these light patterns as a way of estimating the size of the induced refractive index change in the waveguides. See column 8, lines 42-58 for a description of this estimation apparatus and technique. Lines 52-56 explain the origin of the fringes in the illustrated far-field patterns, which are described respectively at column 9, line 21-23 and column 10, lines 6-7. The "Brief Description of the Drawings" section also makes it clear that these figures show the far-field output patterns of waveguides, and not the focused light spots used to form the waveguides.

Therefore, for at least the above reason, *Aitken* does not anticipate nor render obvious claim 1.

Claim 1 is further not rendered obvious by a combination of *Brienza* with *Aitken*. *Brienza* describes how to fabricate a grating into an existing channel waveguide by using an intensity fringe pattern that stays fixed relative to an optical fibre. *Aitken* would further teach the skilled person how to form a waveguiding channel, by using a focused spot with no fringes. The skilled person would therefore be taught a method of forming a waveguiding channel, which could then have a grating written into it using the method of *Brienza*. *Aitken* does not suggest to the skilled person that the method of *Brienza* could be modified in any way to produce the method of claim 1, because *Aitken* does not teach a light spot with an intensity pattern that is moved relative to a sample.

*Kohnke* was only cited with regard to dependent claims 18-21. In any event, *Kohnke* does not overcome the fundamental deficiency of *Brienza* as a teaching reference vis-s-vis the method of claim 1.

### **Conclusion**

In view of the foregoing, request is made for timely issuance of a notice of allowance.

Respectfully submitted,

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